

Project Plan for Reconstruction Work in Central America

Nicaragua

Phase I

**October 1, 1999 – September 30, 2000
and**

Phase II

October 1, 2000 – December 31, 2001

August 2000

**U.S. Department of Commerce
National Oceanic and Atmospheric Administration
U.S. National Weather Service**

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CENTRAL AMERICA RECONSTRUCTION - NICARAGUA

I. INTRODUCTION

A. Background discussion

The devastation caused by Hurricane Mitch in the Fall of 1998 was unparalleled. The hurricane was one of the most powerful and destructive hurricanes ever observed in Central America with catastrophic loss of life and damage levels. Specific impacts to Nicaragua are as follows:

| | |
|----------------------------|------------------|
| Confirmed Deaths | 3,045 |
| Missing Persons | 970 |
| Victims/Injured | 65,271 |
| Persons evacuated | 368,261 |
| Roadways seriously damaged | 7,300 kilometers |
| Bridges destroyed | 71 |
| Homes damaged or destroyed | 20,000+ |

Total direct damages are estimated at US\$1,500,000,000.

In addition to the severe loss of life and injuries and property destruction, Hurricane Mitch severely damaged or destroyed major portions of the existing hydrometeorological monitoring network which form the basis for forecasts and warnings of hurricanes and other severe weather events.

B. Purpose of the plan

The destruction and loss of life brought to light several problem areas that need to be addressed in a most expeditious manner. With assistance through the USAID, World Bank and other donor organizations, the U.S. Department of Commerce through NOAA will be working with other government technical and administrative agencies (i.e. USGS, COE, FEMA) to assist the Central American nations in implementing programs whose objectives are to minimize future losses of lives and property when natural phenomena on the scale of Hurricane Mitch again target the region. The purpose of this plan is to provide additional levels of detail to the U.S. Department of Commerce's Implementation Plan for Reconstruction Work in Central America. Specifically centered on NOAA's support to the reconstruction effort in Nicaragua. This "Project Plan" will document the activities performed by the Department of Commerce, National Oceanographic and Atmospheric Administration, U.S. National Weather Service (NWS) under the Interagency Agreement (IAA) signed on September 14, 1999. The IAA between the U.S. Department of Commerce (DOC) and the U.S. Agency for International Development (USAID) defines the reconstruction work in Central America (Hurricane Mitch) and the Caribbean (Hurricane Georges). The IAA incorporates the U.S.

Department of Commerce's Implementation Plan for Reconstruction Work in Central America, July 1999. This Project Plan will address the activities proposed in the DOC plan as well as the problems, issues, objectives, management approach, coordination of activities and applications to other project plans for the reconstruction program.

This Project Plan includes both Phase I (October 1, 1999 to September 30, 2000) and Phase II (October 1, 2000 to December 31, 2001).

This Project Plan was used to develop Memoranda of Agreements between NOAA/NWS and the Government of Nicaragua (GON).

The focus of the NOAA/NWS Project Plan is for reconstruction, repair and expansion of Nicaragua's hydrometeorological monitoring networks and the development of early-warning systems focusing on weather related disasters through the provision of technology, technical and management support and training (capacity building). An important continuing aspect of this Plan is the identification of the appropriate GON counterpart agencies that benefit from the acquisition this sustainable technology.

II. STATEMENT OF THE PROBLEM/ISSUES

Nicaragua's needs and requirements can be partitioned into (1) those occurring as a result of Hurricane Mitch (either directly or indirectly) and, (2) those which existed prior to the hurricane's arrival. Although the term "reconstruction" is used throughout these project and implementation plans, it should not be defined as meaning replacing what had been destroyed, with identical systems, items or facilities. As with many devastating events, the "silver lining" is the opportunity, not to replace but to augment and re-engineer former systems whether focusing on facilities and equipment or more general infrastructure issues so that they better support Nicaragua's disaster avoidance capabilities. The most adverse factor exacerbated by Hurricane Mitch was the lack of sufficient forecasting, monitoring, and analyses capabilities for assessing vulnerabilities to severe weather phenomena. An efficient and effective disaster response system was not in place. The major information network providing critical hydrometeorological observations prior to the arrival of Mitch was already insufficient, obsolete and poorly maintained and impacted negatively on the GON ability to properly identify impending dangerous conditions and to properly warn impacted and potentially impacted areas. After Mitch over half of their limited stream gauging stations and a large part of their rainfall and agrometeorological and climatological observation stations were damaged or destroyed. Additionally, both the agency responsible for the monitoring of hydrometeorological situations and the gathering of hydrometeorological data as well as those organizations who have a critical need for these data have a limited ability to respond to extraordinary weather events due also to limited financial and human resources as well as lack of appropriate technology.

From a hydrometeorological aspect, Nicaragua has many varied and immediate needs that first deal with the provision of timely severe weather watches and warnings to the public followed by an overall improvement in the quality and timeliness of hydrometeorological information to the user community.

Utilizing the U.S. Department of Commerce's Implementation Plan for Reconstruction Work in Central America, as well as input from the Project Proposal of the World Meteorological Organization entitled, Support of Natural Disaster Prevention and Water Resources Management – Modernization of National Hydrological and Meteorological Services Affected by Hurricane Mitch dated June 1999 and the USAID/Nicaragua document – Hurricane Mitch Reconstruction – USAID/Nicaragua Special Objective, these needs and requirements fall into several broad categories below. Additionally, activities for each of the following areas were identified through meetings with GON counterpart agencies, meetings with non-government organizations (NGOs) and with the USAID Mission in Nicaragua. The Project Plan in Nicaragua is consistent with the USAID/Nicaragua Mission “Hurricane Mitch Reconstruction Special Objectives Document (SPO).

A. Base Infrastructure Reconstruction

(1) Reconstruct and Improve Meteorological Data Collection Networks

Much of the existing hydrometeorological monitoring network was destroyed by Hurricane Mitch or is in a state of disrepair. This network of data collection platforms, manned weather observatories and telecommunications systems is essential for the provision of accurate and timely forecasts and warnings of severe weather and other natural events, and is of paramount importance for any significant improvements to the country's forecast and warning capabilities.

(2) Reconstruct and Improve Water Level Networks

Accurate water level information, whether provided by tide gauges along the coast or river stage monitoring is essential for ship and barge navigation, coastal surveying and mapping, storm surge and tsunami warning, responses to hazardous spills as well as for vulnerability assessments and the development of hazard mitigation activities. Some of the existing gages have been damaged or destroyed by Mitch while others have been inoperative for a while due to problems with maintenance and spare parts.

(3) Develop Satellite Data Receiving, Processing, and Analysis Capability

In addition to the standard APT/WEFAX meteorological satellite receivers found at most national hydrometeorological services, there may be a need for high resolution data (HRPT) especially in issuing mesoscale forecasts and warnings.

B. Forecast and Early Warning Systems

(1) Develop Country Strategic Implementation Plans

Prior to Mitch, strategic implementation plans were, for the most part, ineffective, incomplete or entirely missing in the areas of forecasting and warning as well as disaster prevention and mitigation areas.

(2) Reconstruct and Improve Flood Forecast Networks

Observation points throughout the various river basins are critical to the forecasting of floods. Both river stage and rainfall measurements are critical in the forecast and warning process. Although there appeared to be significant numbers of precipitation gages, nearly all were read only every two weeks when the hydrograph paper was replaced. Such instrumentation while acceptable for studies is useless in supporting real time flood forecasting.

(3) Establish Flood Forecast System

A need exists for a fully integrated flood forecasting system. Portions of the National Weather Service River Forecasting System (NWSRFS) can be made available to Nicaragua (and other Central American countries) to provide proven methodologies to better forecast floods.

(4) Early Warning Systems

Many of those killed as a result of Mitch were drowned by flash floods that occurred as a direct result of record rainfall over short periods of time. Many victims had little or no warning of the impending floods. Systems must be established in flash flood prone areas to alert residents of threatening situations with enough time so that positive action can be taken to safeguard lives and property.

(5) Develop Regional Seasonal Climate Prediction System

Mitch's effects were exacerbated by seasonal climate variations associated with El Niño-Southern Oscillation (ENSO). There exists a need in the region for the

production and application of seasonal climate forecast information in an integrated and systemic fashion.

C. Disaster Preparedness and Response

It is vital that Nicaragua strengthen the linkages among the various disaster preparedness agencies such as the hydrometeorological service (INETER), the Nicaraguan Civil Defense Agency, the Geophysical Agency as well as the commercial and private sectors so that all can participate in developing appropriate plans for all disasters. For example, petrochemical and other facilities where there is a concentration of hazardous materials put both the public and natural resources at risk from exposure in the event of a natural disaster. Support from the meteorological and hydrological services is of paramount importance in supporting the remedial efforts.

D. Training and Capacity Building

Shortages of trained personnel exist at the National Meteorological and Hydrologic Services and within the Emergency Management Agencies.

III. PROJECT OBJECTIVES

There are three basic issues that must be addressed regarding the reconstruction efforts in the area of hydrometeorological systems

First, wherever the opportunity is present, Nicaragua with assistance from NOAA should take a broader view to reconstruction than the simple replacement of equipment and facilities with identical replacements. Nicaragua, with assistance from the donors, should take the opportunity to revamp and restructure its Service, modify its operation to better meet the needs of its user communities, and fully integrate its physical and human systems into a more cohesive and efficient operation.

Second, Nicaragua, with the assistance of the donors, should identify "appropriate technology" and scientific applications to meet the user communities' requirements. Appropriate within the technological capacity of the users and within the financial constraints of the government to operate and maintain.

Third, Nicaragua must allocate sufficient resources (both human and financial) to the support of these new and existing systems so that they continue to operate after the "project" funds have been spent.

The GON counterpart agencies for the NOAA in the implementation of these reconstruction activities are defined below.

INETER – *the Instituto Nicaraguense de Estudios Territoriales* (containing the National Meteorological and Hydrological Services)

MAG-FOR – *the Ministry of Agriculture and Forestry*

INIFOM – *the Instituto Nicaraguense de Fomento Municipal*

DEFENSA CIVIL – *Department of Civil Defense*

A. Base Infrastructure Reconstruction

(1) Reconstruct and Improve Hydrometeorological Data Collection Networks

There are two objectives within this activity. The first objective is to identify the specific hydrometeorological data and information needs of Nicaragua by working with INETER and their user community. This requires an evaluation by INETER management with assistance from NOAA to determine which damaged or destroyed observational sites must be repaired/replaced as well as where new observation sites should be established.

NOAA will replace 5 sites with automatic hydrometeorological observing stations using satellite communications. The specific sites are listed in the following tables.

NOAA will provide 11 automatic precipitation-only gauges transmitting to the GOES satellite in remote locations to strengthen the forecast and warning network. The network design will be based on a needs assessment for establishing early warning and flood forecasting capability.

NOAA will provide INETER Headquarters with up to 12 personal computers and associated equipment to facilitate the management of the organization and the sharing of operational, technical and management information. This includes assisting INETER with the design and implementation of a Local Area Network (LAN) linking the Administration, Meteorology, Hydrology and Geophysics Divisions.

(2) Reconstruct and Improve Water Level Networks

NOAA will work with the USGS and the COE to identify and repair/ tide gauges along the coast or river stage gauges as funds permit.

(3) Develop Satellite Data Receiving, Processing, and Analysis Capability

NOAA will provide real time satellite imagery products to supplement whatever other sources of satellite imagery exist. NOAA will also provide access to High-Resolution Picture Transmission (HRPT) data from a receiving station located in Costa Rica.

B. Improve Forecast and Early Warning Systems

(1) Develop Country Strategic Implementation Plans

This activity will provide INETER and related agencies with support from NOAA and other USG agencies in the development of strategic plans for the improvement of Nicaragua's hydrometeorological forecasts and warnings over a 10 year period. This effort will include assistance in defining the user community, public relations, defining user needs, preparing cost/benefit studies, budgeting and finance, human resources, and other management support.

(2) Reconstruct and Improve Flood Forecast Networks

NOAA will work with the USGS in appropriately siting stream gauges in support of real time flood and flash flood forecasting and warning. Instrumentation, while providing information to the local residents will also provide the critical data directly to INETER, Civil Defense, MAG-FOR, power companies and many others in both the public and private sectors via a variety of telecommunication systems.

(3) Establish Flood Forecast System

Portions of the National Weather Service River Forecasting System (NWSRFS) will be installed on the Rio Escondido river basin with field instrumentation installed at locations appropriate for the various models to run as well as the necessary computer capacity to run the model at the INETER office. Once the NWSRFS is successfully installed within this basin, the INETER hydrologists, with training, will be able to expand the forecast system into other basins. NOAA

will assist INETER with the establishment of a River Forecast Center at INETER Headquarters.

(4) Early Warning Systems

In addition to the National Weather Service River Forecast System (NWSRFS) to be installed on the Rio Escondido (see section 3 above), 2 ALERT (Automated Local Evaluation in Real Time) systems will be installed. These ALERT systems consist of the installation of precipitation and stream gauges at upstream locations to measure hydrometeorological parameters that indicate flooding potential at key population centers connected by communication links to personal computers and warning devices such as sirens, horns and/or flashing lights. These ALERT systems serve two purposes, first to warn the population downstream from a flash flood generating storm to move to a place of safety and second, to provide INETER and the Civil Defense with hydrometeorological information critical in determining the severity of the flooding.

The data from these systems will be sent to personal computer base stations located at the municipality's civil defense center (or another government security facility such as a police department or fire department), which is manned 24 hours a day. The software will indicate when flood potential becomes critical and will trigger a warning device to warn the populace that danger is a real possibility. Using flood response plans, drills and exercises will be held using the software at the base station to train operators. The process will also include working with INETER and Civil Defense to decide on what criteria to use to cause the evacuation of people. Training will also be given in both the preventative maintenance and the repair of these systems, wherever possible by local personnel.

(5) Develop Regional Seasonal Climate Prediction System

NOAA will provide basic training in seasonal forecasting especially related to El Niño occurrences. An integrated effort is envisioned with the full participation of INETER, NGOs and the user community to define and provide for the production and application of seasonal climate forecast information. This regional based system will be established in Costa Rica with real time product links to INETER.

C. Strengthen Disaster Preparedness and Response

Although the Nicaraguan government agencies involved in disaster response efforts performed heroically, it was apparent that many of the institutions lacked the trained

manpower as well as adequate technology to successfully handle an event of this magnitude. A critical objective of NOAA's support will be to work with INETER, MAG-FOR, Civil Defense as well as U.S. Agencies such as FEMA, USGS, SOE, NGOs and private organizations to implement a Wide-area Network (WAN) linking the various government disaster-related agencies together to speed the flow of information so that timely activities can be undertaken to mitigate the loss of lives and property. Initial plans are for INETER to act as the hub of information gathering hydrometeorological information from a variety of sources and distributing the raw data as well as value-added products to other organizations both public and private. This connectivity will link the World Area Forecast System (WAFS), the Internet, and any other natural disaster-related information sources. Information linkages and training in their maintenance and use will be provided to INETER, the Nicaragua Civil Defense, other environmental agencies, the emergency response institutions and others.

D. Training and Capacity Building

Training in the form of short courses and expert visits to INETER and other related agencies are critical to the viability of the complex technical systems being installed. Maintenance as well as operation of the various systems requires a cadre of highly trained and skilled staff. Courses in meteorology with an emphasis on severe weather forecasting (numerical weather models, tropical meteorology, hurricane and tropical storm forecasting, quantitative precipitation forecasting, mesoscale modeling, NWSRFS (National Weather Service River Forecast System) Initialization and calibration as well as participation in the NWSRFS users workshops held regularly will be needed. Other training will focus on ALERT Systems, warning dissemination, communications, as well as liaison with the private and public sectors. All training will be conducted in Spanish. To the maximum extent possible, all operations and maintenance manuals will be available in Spanish.

A vital, but often overlooked training area of paramount importance is how meteorologists, hydrologists and disaster-related professionals relate to the entire user community. Training on how to interact with the user community to provide them with information vital to their interests in a format they can understand and in a time period useful to them will be stressed. By bringing the producers of environmental data and products together with the users, common ground can often be found that will provide funds for the maintenance (sustainability) of those systems which provide the critical data.

IV. COORDINATION OF ACTIVITIES

Close coordination in being maintained with the U.S. Geological Survey, the U.S. Corps of Engineers as well as Nicaraguan agencies and NGOs in locating appropriate field sites and sharing hardware platforms and data. Other U.S. agencies involved in the Mitch Reconstruction effort with which NOAA shall participate include:

NOAA- National Ocean Service

Installation of meteorological sensors on tide gauges and at Continuously Operating Reference Sites (for GPS), where applicable.

NOAA – National Environmental Satellite, Data, and Information Service (NESDIS)

Implementation of one kilometer resolution satellite imagery capability – coordination of imagery processing hardware and software within counterpart agencies.

NOAA – Office of Global Programs

Implementation of climate forecasting capability within counterpart agencies

U.S.Geological Survey

Installation of streamflow gauges – coordinate needs for flood early warning systems and co-located meteorological measurements instrumentation; coordinate with Internet needs and capabilities

Federal Emergency Management Agency (FEMA)

Coordination on the development of emergency plans to support implementation of flood warning systems

USAID Nicaragua

Coordination with implementing NGOs on disaster preparedness and management planning

USAID – OFDA

Coordination with the disaster preparedness assessment and recommended actions

World Bank

Coordination on program expansion, maintenance and sustainability issues.

Inter-American Development Bank

Coordination on program expansion, maintenance and sustainability issues.

World Meteorological Organization

Coordination on Long-Term Planning

Activities proposed for Nicaragua are depicted in the following tables.

Table 1 NOAA/NWS Activities in Nicaragua – Base Infrastructure Reconstruction

| Activities | Description | Location |
|---|---|---|
| Reconstruct and Improve Hydrometeorological Data Collection Networks | 1. Provision of up to 12 personal computers and associated equipment to facilitate the management and administration of the organization and the sharing of operational, technical, and management information and connection to the existing LAN | Administrative offices at INETER Headquarters |
| | 2. Provision of 5 automatic weather stations (DCP – data collection platform based, with satellite data transmission and/or line-of-sight communication) at synoptic observation locations. | Granada, Boaco, Chinandega, Esteli, Fatima |
| | 3. Provision of 12 automatic precipitation stations (DCP – data collection platform based, with satellite data transmission and/or line-of-sight communication) 4 of which are associated with ALERT systems. | San Isidro, Betulia, Bluefields El Arenal, El Coral, Los Laureles, Villa Sandino, Wapi Teustepe, Las Banderas, Cinco Pinos, San Francisco del Norte |
| Reconstruct and Improve Water Level Networks | 1. Work with USGS by providing meteorological sensors on DCPs attached to stream gauges as funding permits | Locations to be determined by INETER and USGS* |
| Develop Satellite Data Receiving, Processing, and Analysis Capability | 1. Provision of real time satellite imagery over the World Area Forecast System (WAFS) and access to High-resolution Picture Transmission (HRPT) data from a receiving site in Costa Rica | Provision to the INETER Meteorological Forecast Office at the airport with connection to the INETER LAN. |

Table 1 continued NOAA/NWS Activities in Nicaragua – Improve Forecast and Early Warning Systems

| Activities | Description | Location |
|---|---|--|
| Develop Country Strategic Implementation Plans | 2. Development of detailed strategic implementation plans for improvement of hydrometeorological forecasts and warnings. Public relations, defining the user community, defining user needs, preparing cost/benefit studies, budgeting and finance, human resources, other management support. | INETER Headquarters |
| Reconstruct and Improve Flood Forecast Networks | 3. NOAA will work with USGS and INETER in appropriately siting stream gauges in support of real time flood and flash flood forecasting and warning. | INETER determined sites |
| Establish Flood Forecast System | 4. The National Weather Service River Forecast System (NWSRFS) will be implemented for the Rio Escondido river basin. This includes the siting of appropriate hydrometeorological observation sites and stream gauges, initialization and calibration training. | Rio Escondido (Basin No. 61) with the NWSRFS run at the INETER Forecast Facility |
| Early Warning System | 5. Two (2) ALERT-type systems will be installed in flash flood prone areas with communication links tied to emergency centers. Sensors may include stream gauges, precipitation gauges, and other appropriate sensors. Systems also includes personal computers, communication links, and warning devices (i.e. sirens, flashing lights). | Malacatoya, Somotillo |
| Develop Regional Seasonal Climate Prediction System | Training of INETER personnel and involvement of the user community in the latest model techniques | INETER Headquarters |

Table 1 continued NOAA/NWS Activities in Nicaragua – Strengthen Disaster Preparedness and Response

| Activities | Description | Location |
|--------------------------------|---|----------------------|
| Wide Area Network | Design and Installation of a Wide Area Network (WAN) linking INETER, MAG-FOR, Civil Defense and other critical agencies and information users | Throughout Nicaragua |
| Training and Capacity Building | Training in the form of short courses and expert visits both in the maintenance and use of the new technological systems and in the development of a more informed user community | Throughout Nicaragua |

V. APPLICABILITY TO OTHER PLANS

This plan is compatible with the reconstruction needs of Nicaragua as described in the Department of Commerce, USAID, World Meteorological Organization plans and will be coordinated with USDA, USACE, FEMA, USGS, COE, OFDA and other appropriate agencies.

VI MANAGEMENT PLAN

NOAA Management Structure and Responsibilities

The NOAA has provided a management structure to ensure the Nicaragua program meets all USAID requirements and commitments. The NOAA managers directly responsible for this project include the NOAA Project Manager and the Nicaragua Country Manager. Their responsibilities are as follows:

NOAA/NWS Project Manager

- Develop and track project schedules and budgets
- Develop overall technical approach and tasks for each country and the region
- Develop country and regional work plans including a detailed cost plan
- Attend program meetings as required by NOAA management and USAID
- Coordinate all local and in-country technical advisors, as appropriate
- Work with the NOAA Program Manager to coordinate activities and integrate tasks with other USG agencies
- Address line office, NOAA/DOC and USAID administrative requirements, including reporting requirements
- Provide input to the NOAA Project Manager for the NOAA quarterly progress report due to USAID
- Coordinate Country and Regional Managers and activities, as appropriate
- Coordinate activities with other NOAA line offices
- Develop contractor Statements of Work (SOW) and Coordination of contractor activities with the NOAA Program Administrator
- Coordinate activities (including country clearances) with the NOAA Program Manager, USAID in-country missions and USAID/Washington program coordinators, as appropriate
- Coordinate with the NOAA Program Manager and the Nicaragua Country Manager for additional, future donor support for appropriate project tasks
- Coordinate the development of the Memoranda of Understanding between NOAA and GON counterpart agencies.

NOAA/NWS Nicaragua Country Manager

- Coordinate all country-specific technical tasks
- Track schedules and tasks
- Coordinate all Nicaragua activities with the line office project manager, Nicaragua USAID mission, counterpart GON agencies, other USG agencies and any technical advisors and coordinators in Nicaragua
- Assist the NOAA/NWS project manager with the development of a project plan for NOAA activities in Nicaragua and with administrative and reporting requirements
- Coordinate NOAA/NWS contractor activities in Nicaragua
- Coordinate shipping of equipment with the Nicaragua USAID Mission
- Address personnel safety and security issues with in-field personnel (contractor and government) and the Nicaragua USAID missions
- Coordinate activities and requirements with Nicaragua Private Volunteer Organizations and Non-Governmental Organizations (NGOs), e.g. development of disaster preparedness/management plans
- Development Memoranda of Understanding between NOAA and GON counterpart agencies
- Work with the INETER to develop short- and long- term strategic plans
- Work with other donors, including USAID, to expand and extends the implemented programs

NOAA/NWS Contact Information

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Counterpart Agencies Points-of-Contact

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Mauricio Rosales, Meteorologia
Luis Palacios, Recursos Hidricos
Isaias Montoya, Meteorologia
Fabio Segura, Geofisica
Wilfrid Stauch

DEFENSA CIVIL

Mayor Perezcassar
Coronel Joes Daniel Garcia

MAG-FOR

Eddy Jerez
Eduardo Marin

Nicaragua USAID Mission Assistance

It is understood that the USAID Nicaragua Mission will be the focal point for all NOAA activities in this country. This includes acting as liaison between the NOAA, its contractors and appropriate GON counterpart agencies. Accordingly, the USAID Nicaragua Mission will need to assist the Nicaragua Country Manager with the following, at a minimum.

- All in-country activities involving NOAA and its contractors including organizing meetings with and support from counterpart agencies, PVOs and NGOs and arranging for translators, if needed.
- Country clearances for the NOAA and its contractors
- Shipping and storage of equipment into Nicaragua
- Development of Memoranda of Understanding between NOAA and GON counterpart agencies
- Obtaining office workspaces and other support as needed.

Results Framework

Measures of Progress and Measures of Effectiveness for each of the Problem/Program areas and activities have been defined in the U.S. Department of Commerce's Implementation Plan for Reconstruction Work in Central America. The Measures of Progress are all activity outputs based on successful implementation of the defined activity.

Program Sustainability

NOAA will work with the Nicaragua USAID Mission, GON counterpart agencies and other donors to develop a long-term strategy for expanding and sustaining the programs implemented. The NOAA will initially develop routine maintenance costs for the proposed hardware and software to be installed and then work with the GON counterpart agencies to ensure that appropriate budgets are defined to sustain these systems. If the budget is beyond the capabilities of the agency, the program will be revised accordingly. The NOAA will also hold discussions with donors and Central America regional agencies to determine the best approaches to sustain these programs. A separate activity to look at regionalization of certain hardware and software maintenance needs and requirements is provided for in the DOC regional program.

Equipment Turnover

After successful installation and checkout, all hardware and software will officially be turned over to the GON. This will be accomplished per the Nicaragua USAID Mission requirements and under the conditions specified by the Memorandum of Understanding (MOU) with the appropriate GON agency. Once the equipment becomes the property of the GON, all maintenance responsibility becomes their responsibility unless otherwise specified in the MOU.

VII. A. SCHEDULE

| Installation, Operational or Implementation Date | Activity |
|---|---|
| By 30 September 2000 | <p>1 Automatic Weather Station – Granada</p> <p>1 Automatic Precipitation Station – San Isidro</p> <p>1 ALERT Base Station System – Malacatoya</p> <p>1 ALERT Precipitation Station – Las Banderas</p> <p>Pre-installation training for automatic weather station equipment and operations (Managua)</p> <p>Design of the Nicaragua River Forecast System with focus on the Rio Escondido</p> <p>Meteorologist training at the International Forecasting Desk in Washington</p> |
| By December 31, 2000 | <p>Office personal computers</p> <p>Establishment of a Local Area Network linking all INETER departments</p> <p>Operation training for PC station hardware and software</p> |
| By March 31, 2001 | <p>Development of a national strategic implementation plan</p> <p>Provision of test equipment and spare parts for installed systems as needed.</p> <p>Meteorologist training at the International Forecasting Desk in Washington</p> <p>Installation, maintenance, operation and data quality control training for meteorological systems</p> |
| By June 30, 2001 | 1 Automatic Weather Station – Boaco |

| | |
|-----------------------|--|
| | 1 Automatic Weather Station – Chinandega 1 Automatic Weather Station – Esteli 1 Automatic Weather Station – Fatima 1 Automatic Precipitation Station – El Arenal 1 ALERT Precipitation Station – Teustepe |
| By September 30, 2001 | 1 Automatic Precipitation Station – Betulia 1 Automatic Precipitation Station – Bluefields 1 Automatic Precipitation Station – El Coral 1 Automatic Precipitation Station – Los Laureles 1 Automatic Precipitation Station – Villa Sandino 1 Automatic Precipitation Station – Wapi |
| By December 31, 2001 | 1 ALERT Precipitation Station – Cinco Pinos 1 ALERT Precipitation Station – San Francisco del Norte 1 ALERT Base Station - Somotillo |

VII.

VIII. B. BUDGET

The NWS budget for the first phase of the Nicaragua program follows the budget outlined in the Interagency Agreement (IAA) between the Department of Commerce and USAID. Detailed activity budgets have been developed in conjunction with selected contractors to ensure adherence to the IAA tranced budgets. The budget breakdown is shown in the following table.

| Problem Area (PA) | Activities | Description | PA Budget thru 30 September 2000 | PA Budget 1 October 2000 – 31 December 2001 | Total Problem Area Budget |
|------------------------------------|--|--|----------------------------------|---|---------------------------|
| Base Infrastructure Reconstruction | Reconstruct and Improve Hydrometeorological Data Collection Network | Personal Computers 5 Automatic Weather Stations 12 Automatic precipitations 1 Set of spares and test equipment Emergency maintenance as needed | \$253,800 | \$231,200 | \$485,000 |
| | Reconstruct and Improve Water Level Networks | Provision of one stream gauge on the Rio Escondido | | | |
| | Develop Satellite Data, Receiving, Processing, and Analysis Capability | Provision of real-time satellite imagery over the WAFS | | | |

| Problem Area (PA) | Activities | Description | PA Budget thru 30 September 2000 | PA Budget 1 October 2000 – 31 December 2001 | Total Problem Area Budget |
|------------------------------------|---|---|---|--|----------------------------------|
| Forecast and Early Warning Systems | Develop Country Strategic Implementation Plans | For improvement of forecasts and warnings, defining the user community and their needs, preparing cost/benefit studies, budgeting human and financial resources | \$708,700 | \$871,300 | \$1,580,000 |
| | Reconstruct and Improve Flood Warning Systems | 2 students for training on the International Desk | | | |
| | Establish Flood Forecasting Systems | | | | |
| | Early Warning System | Installation, maintenance, operation, and data quality control training for field monitoring systems | | | |
| | Develop Regional Seasonal Climate Prediction System | | | | |
| Disaster Preparedness and Response | Wide Area Network | | \$44,700 | \$50,300 | \$95,000 |
| | Training and Capacity Building | | | | |
| TOTAL | | | | | \$2,160,000 |

